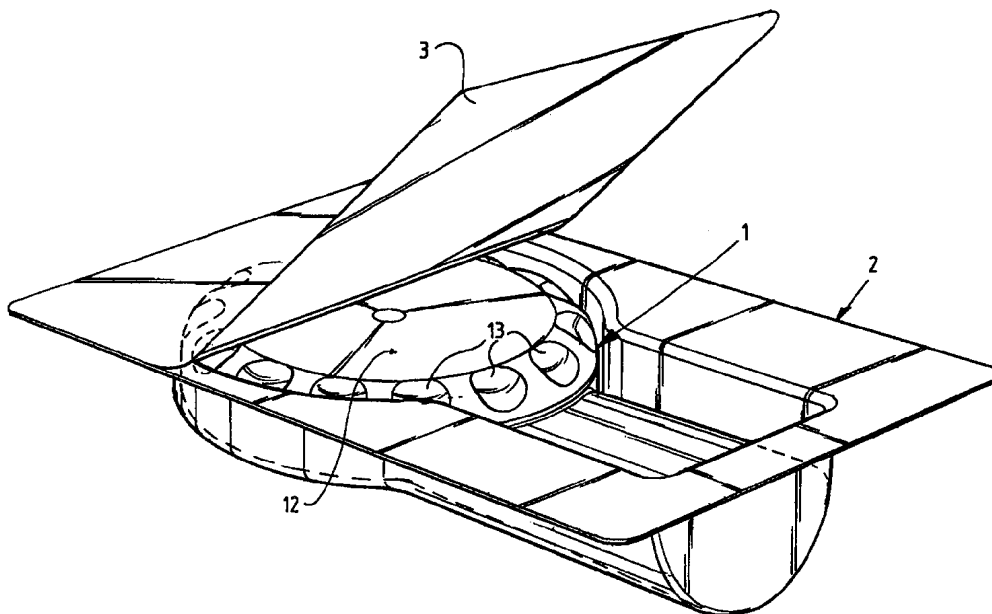




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(21) International Application Number:</b> PCT/NL99/00028 <b>(22) International Filing Date:</b> 15 January 1999 (15.01.99) <b>(30) Priority Data:</b> 1008031 15 January 1998 (15.01.98) NL <b>(71) Applicant (for all designated States except US):</b> PHARMA-CHEMIE B.V. [NL/NL]; Swensweg 5, NL-2031 GA Haarlem (NL). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> VAN GELDEREN, Wilhelmus, Maria [NL/NL]; Dr. Bronstraat 14, NL-1566 KX Assendelft (NL). NIJKERK, Alfred, James [NL/NL]; Nicolaas Witsenkade 17, NL-1017 ZS Amsterdam (NL). SANDERS, Johannes, Wilhelmus, Maria [NL/NL]; Lakenburg 40, NL-2135 DL Hoofddorp (NL). SINOT, Sander, Jeroen [NL/NL]; Crailloseweg 25, NL-1272 ER Huizen (NL). <b>(74) Agent:</b> ARNOLD & SIEDSMA; Land, Addick Adrianus Gosling, Sweelinckplein 1, NL-2517 GK The Hague (NL).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i> <i>In English translation (filed in Dutch).</i>

**(54) Title:** DEVICE FOR INHALING MEDICAMENT**(57) Abstract**

The present invention comprises a device for inhaling medication, comprising: a first housing part provided with one or more cavities in which a dose of a pre-determined quantity of medication can be arranged; and a second housing part which is fixed substantially non-releasably to the first housing part, wherein the first and second housing parts are movable relative to one another between a first position wherein the cavities with powdered medication are closed and a second position in which the cavity is placed into connection with an air path and the medication can be inhaled.

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# DEVICE FOR INHALING MEDICAMENT

Devices for inhaling medication, for instance for asthma patients, are very common nowadays. Already known are so-called multi-dose inhalers, wherein one powdered (or liquid) dose at a time is transported from a reservoir to a mixing space, whereafter, after suction, the medication reaches the bronchial tubes of the user via the mouth. Inhaler devices further exist wherein one or more doses arranged in a blister pack are placed in a device, whereafter the medication can be inhaled after piercing of the blister pack. It is also known to inhale from an inhaler device the content of a capsule which must first be pierced or divided.

From the American patent specification 5.622.166 an inhaler device is known wherein a disc-shaped blister pack is rotated each time and perforated by a pin which can be operated by a coil spring. This construction is relatively complicated and expensive and is not suitable as disposable inhaler device; only the blister pack is discarded.

The present invention has for its object to provide a disposable inhaler device which can be manufactured in large numbers at relatively low cost price; the dimensions thereof can remain extremely small, so that the user can readily take along one or more of such inhaler devices and throw them away after use.

The present invention provides a device for inhaling medication, comprising:

- a first housing part provided with one or more cavities in which a dose of a pre-determined quantity of medication can be arranged; and
- a second housing part which is fixed substantially non-releasably to the first housing part,

wherein the first and second housing parts are movable relative to one another between a first position wherein the cavities with powdered medication are closed and a second position in which the interior of one of the  
5 cavities is placed in connection with an air path and the medication can be inhaled.

In a first preferred embodiment the movable part is rotatable, wherein a number of cavities for the medication for dispensing is accommodated in the  
10 rotatable part. It is however also conceivable for the first and second housing parts to be mutually slidable. The rotatable part is preferably rotatable in one direction and a clear click is audible and can be clearly felt as soon as a dose is rotated to the dispensing  
15 position. If the rotatable part is accidentally revolved too far without a dose being inhaled, this dose is again closed off from the environment with further rotation. Since in the preferred embodiment the device is blocked after the last dose has been rotated into the air path, a  
20 dose which has been revolved too far further remains inaccessible.

In a further preferred embodiment the device is enclosed by a liquid-tight and/or airtight packaging in order to prevent the medication becoming moist (and  
25 possibly lumpy) and/or losing its activity over a longer period of time. On this outer wrapper can be further arranged information relevant to the product and it also serves as guarantee for the user that the device is definitely safe and has not been used before. A number of  
30 devices according to the present invention can also be arranged in a blister-type packaging.

The number of doses can amount to one, for instance in the case of morphine, but can also amount to four or more, for instance sufficient for use in one  
35 week.

Further preferred embodiments solve the problem of inexpert use of an inhaler device according to the present invention; closing means are for instance

provided herein for closing off a dose of medication so that it cannot fall out of the device without being inhaled when this latter is upside down, and/or blocking means for blocking the mutual rotation movement in upside  
5 down position of the device.

Further advantages, features and details of the present invention will be elucidated on the basis of the following description of a preferred embodiment thereof with reference to the annexed drawings, in which:

10 fig. 1 shows an isometric bottom view of a preferred embodiment of a device according to the present invention;

fig. 2 shows an isometric top view of the preferred embodiment shown in fig. 1;

15 fig. 3 is a top view of a component of the preferred embodiment shown in fig. 1 and 2;

fig. 4 shows a disassembled view of the device shown in fig. 1 and 2, wherein the component of fig. 3 is filled with medication;

20 fig. 5 is a view in cross-section along the line V-V of fig. 2;

fig. 6 shows a partly broken-away perspective view of a further preferred embodiment of the device according to the present invention;

25 fig. 7A and 7B show respective partly broken-away views of a further preferred embodiment of a device according to the present invention in a first respectively second position;

30 fig. 8 is a partly broken-away perspective view of a further preferred embodiment of a device according to the present invention;

fig. 9 shows a partly broken-away perspective view of a further preferred embodiment according to the present invention;

35 fig. 10 is a partly broken-away perspective view of a further preferred embodiment according to the present invention;

fig. 11 is a partly broken-away perspective view of a further preferred embodiment according to the present invention;

fig. 12 is a partly broken-away perspective  
5 view of a further preferred embodiment according to the present invention; and

fig. 13 shows a partly broken-away perspective view of a further preferred embodiment according to the present invention.

10 A device 1 (fig. 1-5) is preferably packed in a packaging 2 which is in any case (water-) vapour-tight but preferably also airtight, such as a blister pack, a foil 3 of which can be pulled off a short time before use. Device 1 further comprises a mouthpiece 4 which is  
15 provided on the top side with a raised edge 5 in order to ensure that the device is inserted to the correct distance, but not too far, into the mouth. In an embodiment which is not shown, the device can be arranged in a blister-type packaging in which for instance four or  
20 six devices are included, of which one at a time can then be pressed through the blister pack.

Mouthpiece 4 is preferably formed integrally with a housing part 10 (see in particular fig. 4) and comprises a central bush 6 with a slightly flexible wall  
25 part 7 which is separated from wall part 7 via gaps 32, one of which is visible. Situated on the top side is a suction opening 9 with ribs 11 extending thereover. When the air is sucked in for instance at a minimum quantity of 20 litres per minute, the air moving over the cavity  
30 is drawn in and the powder from the cavity is carried along by the airflow. In the shown preferred embodiment the air resistance is moderate, i.e. a user with low sucking power can also draw the powder from the cavity. On the top the component 10 is preferably further  
35 provided with markings (4, 3, 2 respectively 1) indicating the number of doses still to be inhaled. A lower housing part 12, preferably provided with gripping surfaces 13, is rotatable relative to housing part 10.

In another preferred embodiment (not shown) a suction opening can also be arranged in the bottom in order to further reduce the air resistance and to prevent the air resistance becoming too great if the user should  
5 accidentally place a finger on one of the two suction openings.

As shown clearly in fig. 3, the part 12 is provided with a protrusion 14 for the counting mechanism, while it is further provided with cavities 16, 17, 18 and  
10 19 for receiving powdered medication preferably poured therein. In addition to cavities 16-19, recesses 21, 22, 23, 24 and 25 are arranged for strengthening the structure, saving plastic material and preventing moisture from entering cavities 16-19. Arranged around a  
15 blind hole 30 are obliquely rising wall parts 26, 27, 28 and 29, each co-acting with flexible wall part 7 on housing part 10 during rotation thereof, wherein protruding part 14 co-rotates. A gap 32 is shown in fig. 4 adjacently of flexible wall part 7.

20 After cavities 16, 17, 18 and 19 have been filled with inhalable powder, housing part 10 is locked in snapping manner on lower housing part 12 such that in practice the device cannot be opened by the user. After the snap connection the device is situated in the neutral  
25 position or starting position shown in fig. 2, wherein protrusion 14 indicates that four doses are still available. If the user wishes to inhale a dose, the lower housing part 12 is rotated, wherein flexible wall part 7 rotates along the protruding wall part 26 and falls  
30 between wall parts 26 and 27 with a clicking sound which can also be felt. In this situation (and in the case of subsequent rotation between the other markings shown in fig. 2) an air path is left clear over the relevant cavity and the powder is carried out of the cavity into  
35 the mouthpiece by the underpressure generated by the airflow.

Fig. 5 further shows clearly that the upper part has a substantially conical surface, which connects

onto a conical surface on the lower part situated beneath a snap edge. Between the upper and the lower part a minimal distance (d) is left clear so as to avoid problems in respect of the tolerances in the applied  
5 injection moulding technique; use is preferably made of a high-grade, injection-mouldable plastic which can for instance be re-used for other purposes.

As shown particularly in fig. 3, when in the shown preferred embodiment the flexible wall part arrives  
10 in the end position between the standing end portions of edge parts 29 and 31, in which position the device is blocked against further rotation, the user knows that the inhaler can be discarded, which is indicated by the counting mechanism which no longer points to a number of  
15 still available doses.

After rotating the disc the user can easily suck on the device according to the present invention, this requiring a comparatively simply hand-mouth coordination. In addition, a dosage of medication (for  
20 some medicines with addition of carrier material (such as lactose)) is preferable dispensed in the cavities such that the user feels in mouth and throat cavities that inhalation has taken place.

In a second preferred embodiment of a device 40  
25 (fig. 6) according to the present invention, component 44 is provided for the purpose of strengthening the ratchet mechanism with two pawls 47 and 48, of which pawl 48 is partly broken away in fig. 6 and which both fall into the recesses between inclining protrusions 45, 46, four of  
30 which are arranged on component 42 in this embodiment with four dosages.

The blocking or end stop after inhaling of the final dose then preferably takes place by means of protrusion 49, which also indicates the number of doses  
35 still to be used and, after the final dose, falls in a manner not shown into a recess on the outside of component 42 or clamps against the mouthpiece of component 44.



In order to prevent mutual rotation of components 42 and 44 taking place in the upside down position of device 40, a blocking element 51 is arranged in a recess 50 in component 42, which element, in the case of reversal as according to arrow A, will drop due to its own weight into a respective recess 52 in component 44 which has a smaller depth than recess 50 such that rotation is then blocked. The number of recesses in component 44 will correspond to the number of cavities in which medicinal powder is received. It will be apparent that it is possible to suffice with one cavity when the blocking element is centrally arranged in the point of rotation.

In the embodiment according to fig. 7A and 7B, which is provided for instance with seven doses of powder for inhaling, the medicine is only released when inhalation takes place. In the device 60 a valve 61 blocking the airflow is arranged pivotally on a shaft 62, while in the position of valve 61 shown in fig. 7A, wherein the airflow is blocked, the dose of medicine is covered using a slidable valve element 64.

In the case of (gentle) inhalation, as indicated with arrows B respectively C in fig. 7B, valve 61 pivots on shaft 62 and slide valve 64 is displaced in the direction of arrow D, so that dose d is released and can be inhaled. Slide valve 64 displaces for instance under the influence of a spring element, the force of which in the direction of arrow D is checked in closed position of valve 61, for instance using a finger. When disc 63 is rotated to the following dose, slide 64 is moved back to the position closing off the following dose.

If the preferred embodiment of fig. 8 is held upside down while a dose e is in open communication with mouthpiece 71, this powder will fall into a collecting space 72 formed on mouthpiece 71, while on the inside of suction part 71 a rib 73 is further arranged which forms

a barricade preventing medicinal powder from falling out of the inhaler device.

Because in device 70 as according to fig. 8 the air supply opening 74 is situated in the correct position  
5 on the underside, the powder will not be able to leave the device therethrough in the reversed position.

In the embodiment 80 of fig. 9 of a device according to the present invention, a cylindrical part 82 is placed in the air inlet part 83 close to the centre of  
10 disc 81. A closing lip 84 is fixed to the tube 82. During inhaling the closing lip 84 is lifted by the airflow and an opening is left clear through which the powder can be inhaled by suction over the cavity in which the medicinal powder is situated. It is possible in a manner not shown  
15 to provide device 80 with a spring element to force back the cylindrical part. In another preferred embodiment (not shown) it is conceivable for cylindrical part 82 to be moved back by a ratchet mechanism during rotation of disc 81.

20 In the embodiment 90 (fig. 10) of a device according to the present invention, the dispensing opening is covered using a foil 91 so that the powder P cannot fall out of the receiving cavity. During inhalation the foil will be lifted, whereby the powder  
25 will be drawn along. The foil is for instance fixed using a plastic part for locking thereof.

In the embodiment 95 of fig. 11, a slide 96 in which an opening 97 is arranged is moved outward during inhaling until opening 97 is situated above the cavity  
30 for the powder, so that the powder is drawn along by the inhaling airflow. With further rotation of disc 98 the slide 96 is urged back into a position closing the following cavity.

In preferred embodiment 100 (fig. 12) according  
35 to the present invention the air is drawn in via arrows E laterally above disc 102 through openings 101 and subsequently guided via arrows F in spiral form through the spiral-shaped housing over a dose of powder P. Owing

to the long air path in spiral form, the powder will in practice not leave the device 100 via the spiral-shaped path, or hardly so. In addition to the possibility of creating a long air path, the lateral suction has the  
5 advantage that the user will be unable or hardly able to cover openings 101 with one or more fingers. This embodiment is provided with seven cavities for receiving material for inhaling, for instance for daily use of medication. The diameter of the disc-like component  
10 amounts to for instance 32 mm, in contrast to the embodiment for four doses, wherein this dimension can amount to for instance 25 mm.

In the embodiment 110 (fig. 13) a component 111 provided with a number of, for instance four, blades is  
15 set into rotating movement during inhalation by the air flow as indicated with arrows G. In the space between two blades the air is guided over a cavity in which powder P is situated so that such powder can be inhaled. The device of fig. 13 can have the same dimensions as the  
20 above stated device of fig. 12.

It will be apparent that the above described preferred embodiments, particularly those of fig. 6-13, prevent powder falling out of the inhaler if it is used upside down.

25 The present invention is not limited to the above described preferred embodiments thereof; the rights sought are defined by the following claims, within the scope of which many modifications can be envisaged.

## CLAIMS

1. Device for inhaling medication, comprising:
  - a first housing part provided with one or more cavities in which a dose of a pre-determined quantity of medication can be arranged; and
  - 5       - a second housing part which is fixed substantially non-releasably to the first housing part, wherein the first and second housing parts are movable relative to one another between a first position wherein the cavities with powdered medication are closed
  - 10       and a second position in which the cavity is placed into connection with an air path and the medication can be inhaled.
2. Device as claimed in claim 1, wherein a mouthpiece for inhaling the medication is provided by one
- 15       component of the housing or both components together.
3. Device as claimed in claim 1 or 2, wherein the movable component is rotatable.
4. Device as claimed in claim 3, wherein the movable component is only rotatable in one direction.
- 20       5. Device as claimed in claim 3 or 4, wherein the movable component is substantially disc-shaped and provided with a central air inlet opening for admitting air and a number of receiving cavities for receiving a corresponding number of doses.
- 25       6. Device as claimed in any of the foregoing claims, provided with counting means for counting the number of doses still available.
7. Device as claimed in any of the foregoing claims, provided with a liquid-tight packaging such as a
- 30       blister pack or sachet.
8. Device as claimed in any of the foregoing claims, wherein a clicking sound is audible in the second position.

9. Device as claimed in any of the claims 3-8, wherein the rotatable component is provided with corrugations or gripping surfaces.

10. Device as claimed in any of the foregoing  
5 claims, wherein the first and second housing parts are provided with respective conical parts fitting onto each other for non-releasable mutual fixing thereof.

11. Device as claimed in any of the foregoing claims, wherein the movable part is blocked in a final  
10 position wherein no further dose is available.

12. Device as claimed in any of the claims 3-11, wherein with further rotation a non-inhaled dose is closed off from the environment.

13. Device as claimed in any of the claims 2-  
15 12, provided with an edge on the mouthpiece.

14. Device as claimed in one or more of the claims 4-14, provided with a ratchet mechanism for allowing the movable component to rotate in only one direction.

20 15. Device as claimed in claim 11, 12, 13 or 14, provided with blocking means on the outside of the device for blocking the movable part in the final position.

16. Device as claimed in one or more of the  
25 foregoing claims, provided with closing means which in the rest position close off a dose and which are moved out of the closing position by inhalation in order to release the dose.

17. Device as claimed in claim 16, wherein the  
30 closing means comprise a foil.

18. Device as claimed in claim 16, wherein the closing means comprise a rotatable and slidable valve.

19. Device as claimed in one or more of the foregoing claims, wherein an air suction opening is  
35 arranged on the underside of the device.

20. Device as claimed in one or more of the foregoing claims, provided with a collecting cavity arranged in the top part of the mouthpiece for collecting

a dose of medication in upside-down position of the device.

21. Device as claimed in one or more of the foregoing claims, provided with blocking means for  
5 blocking the mutual rotating movement in upside-down position of the device.

22. Device as claimed in one or more of the foregoing claims, provided with a substantially spiral-shaped air path.

10 23. Device as claimed in one or more of the foregoing claims, provided with a rotatable element with blades.

24. Device as claimed in one or more of the foregoing claims, provided with one or more air inlet  
15 openings arranged in the side wall.

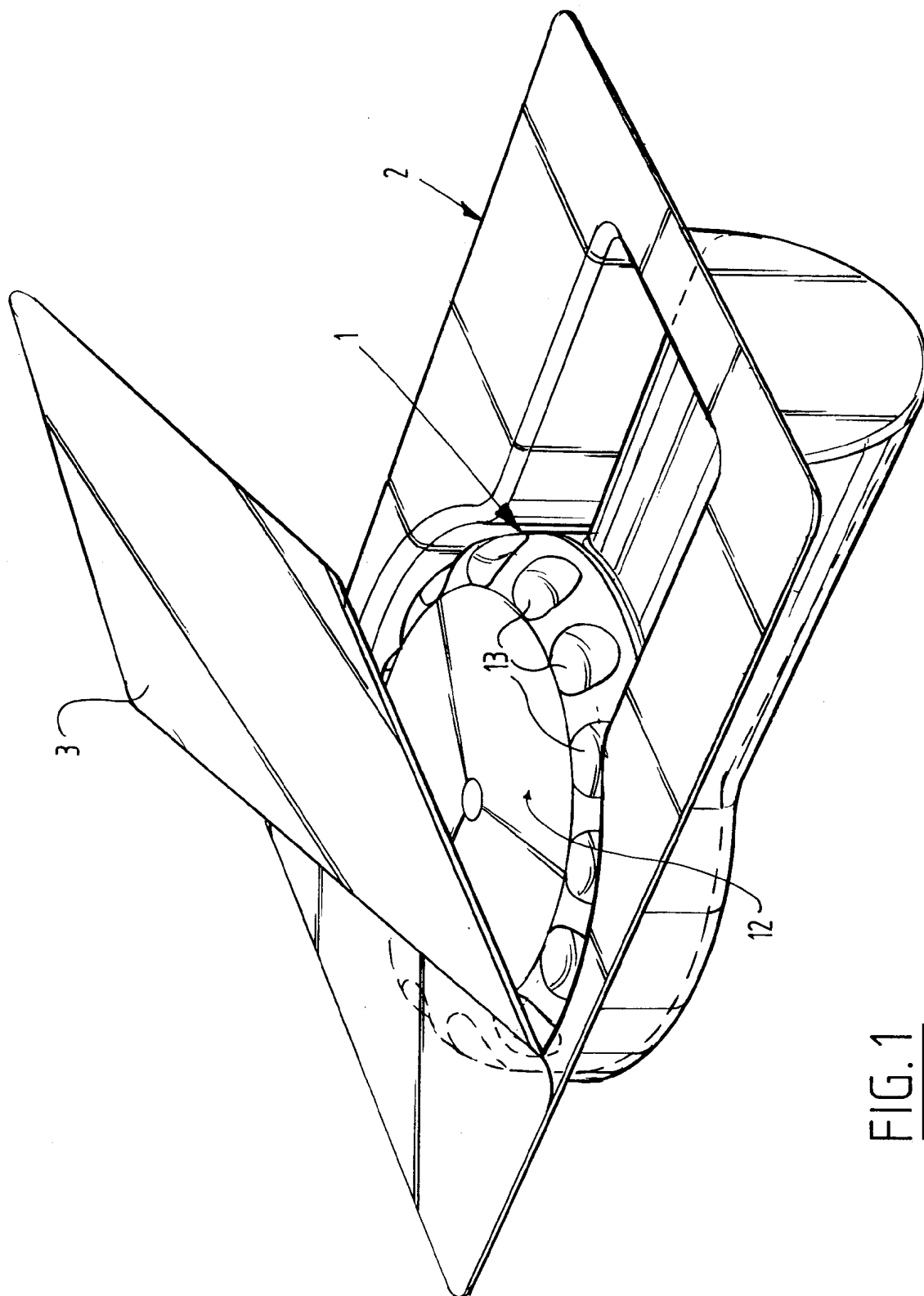


FIG. 1

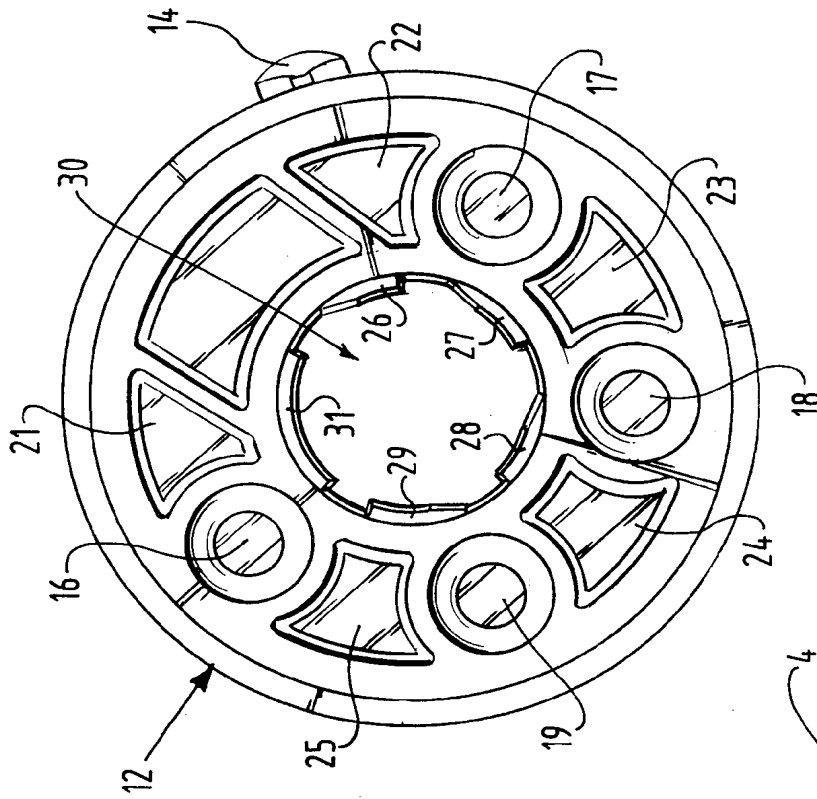


FIG. 3

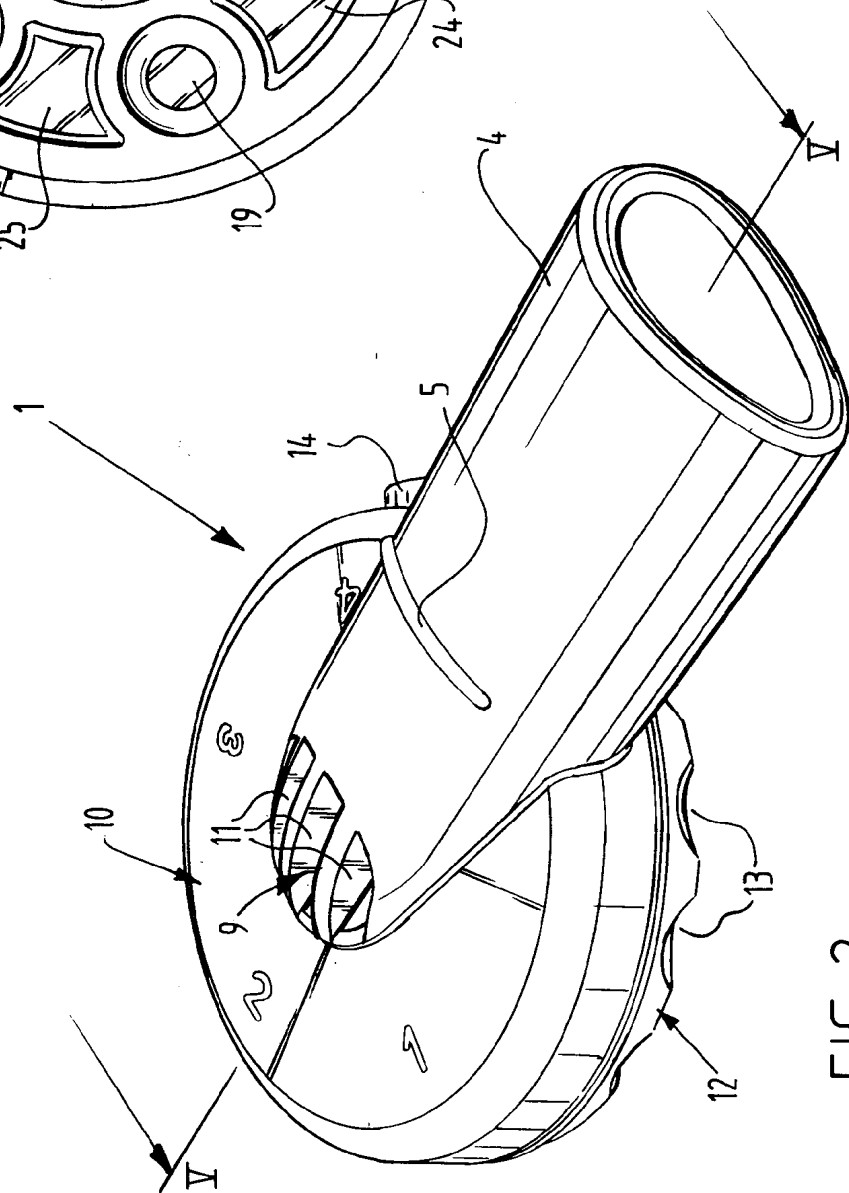


FIG. 2



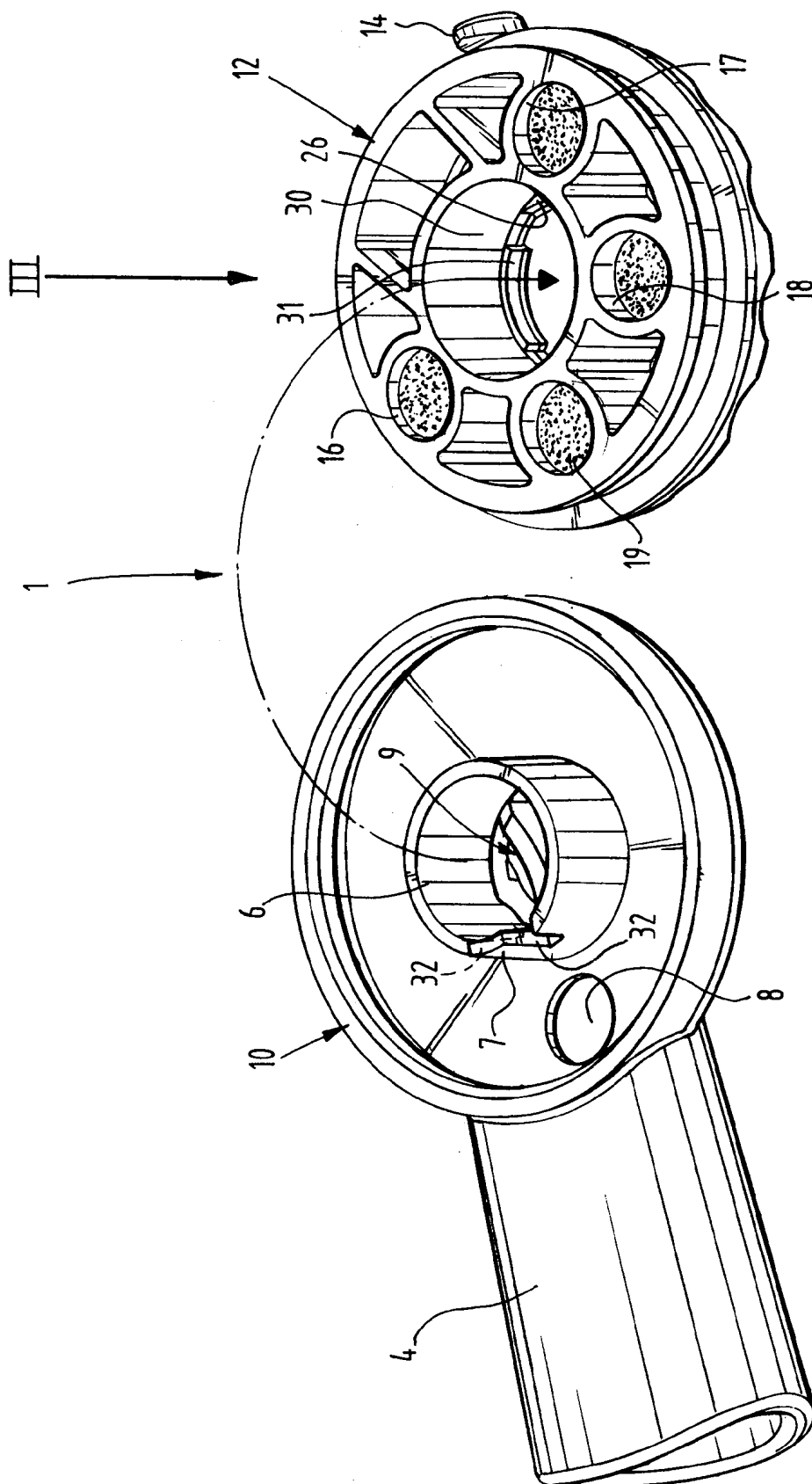


FIG. 4

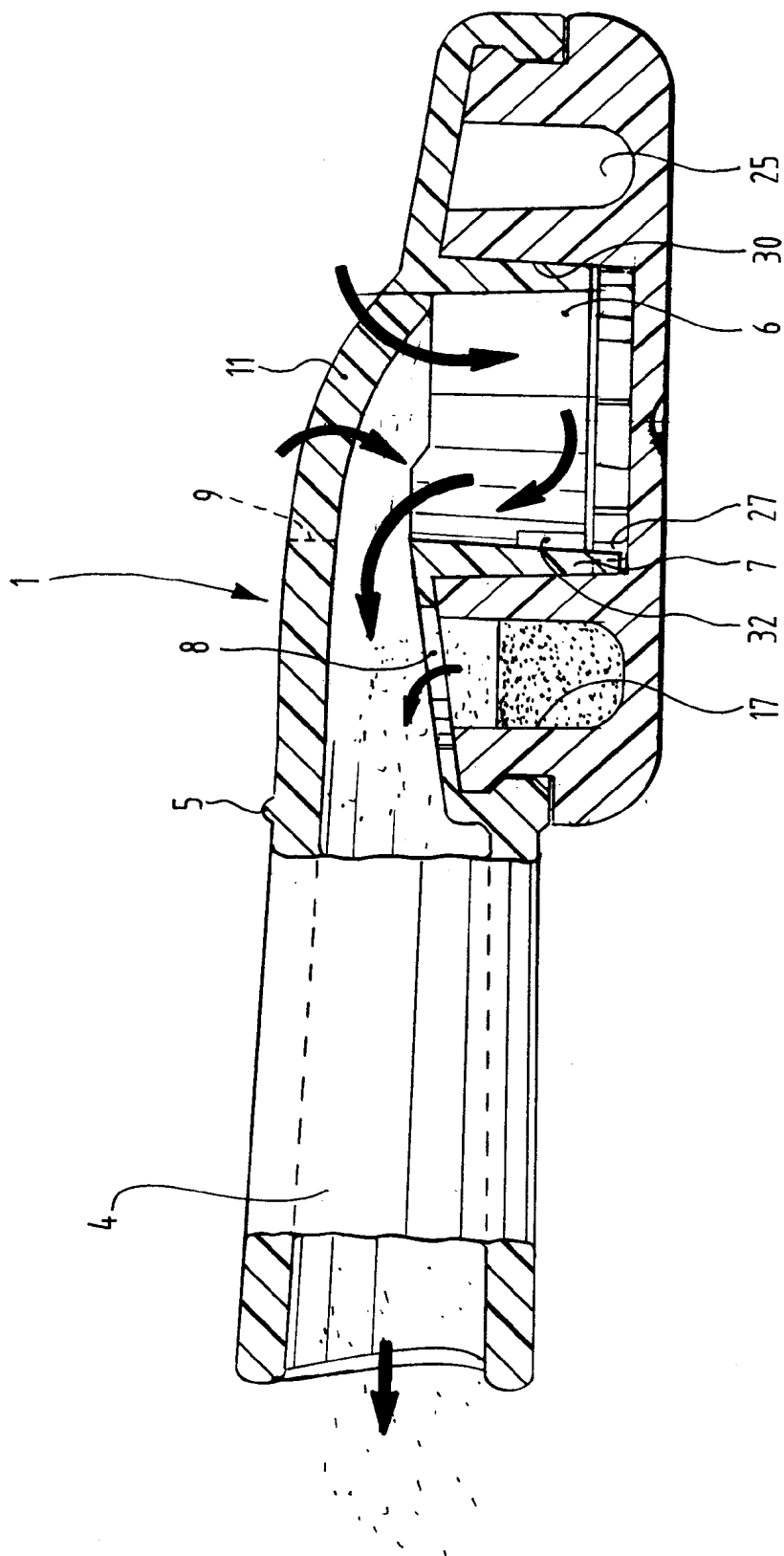
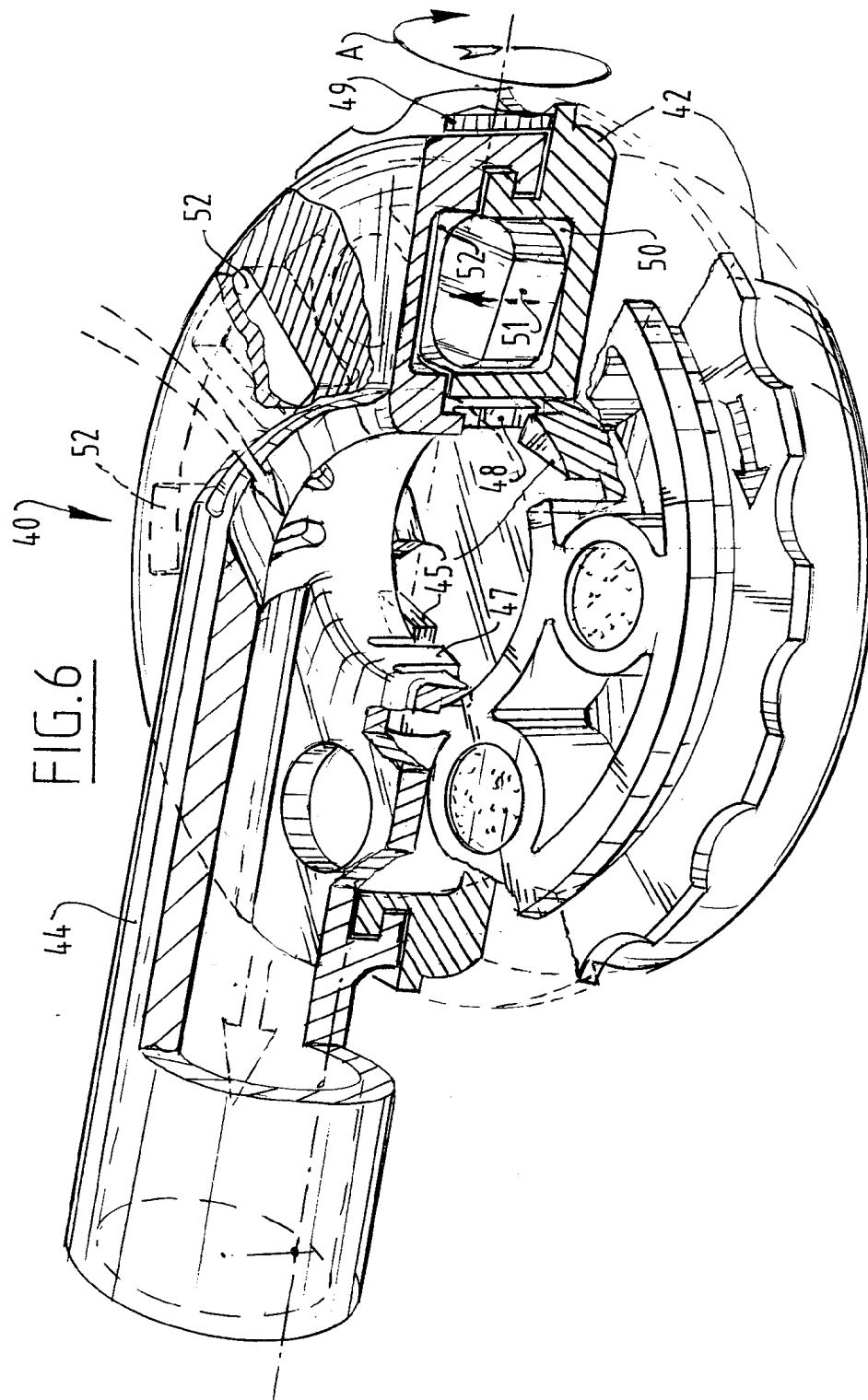
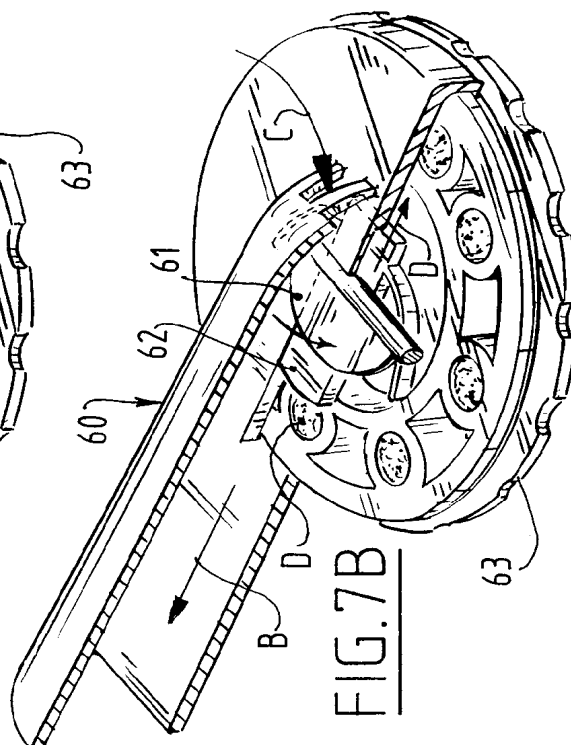
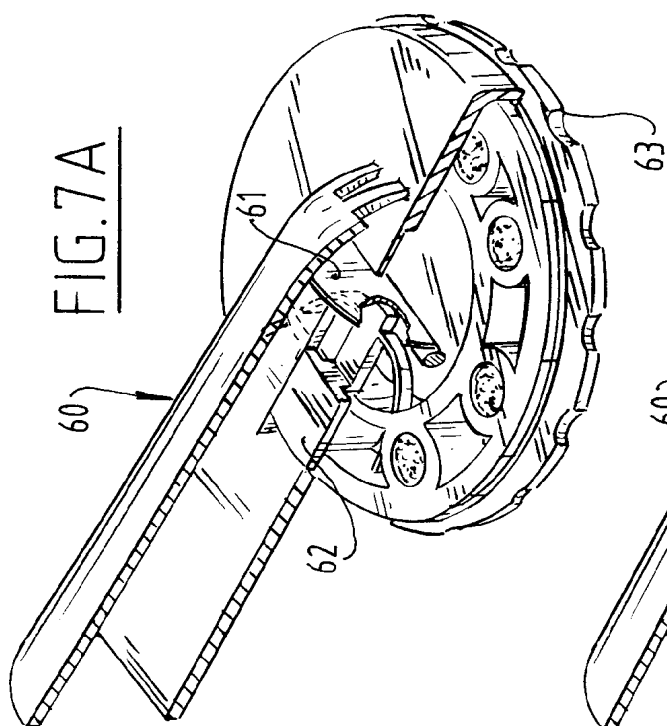
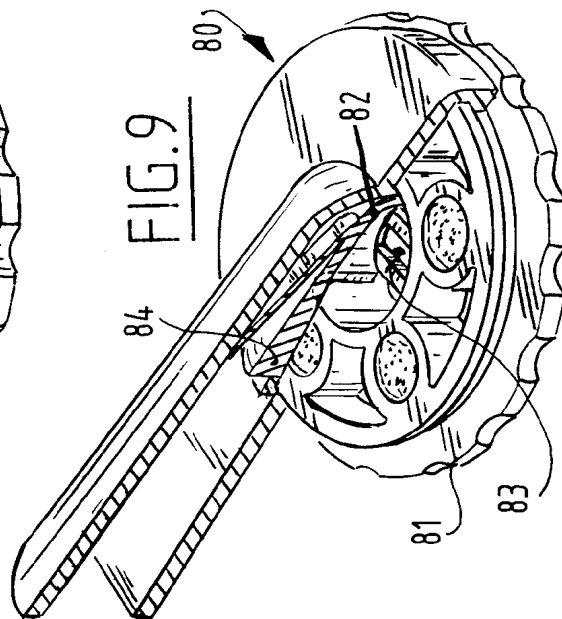
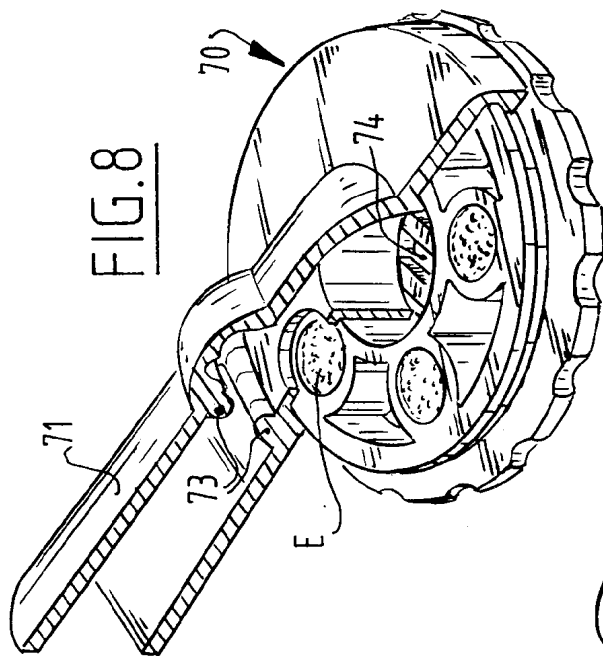
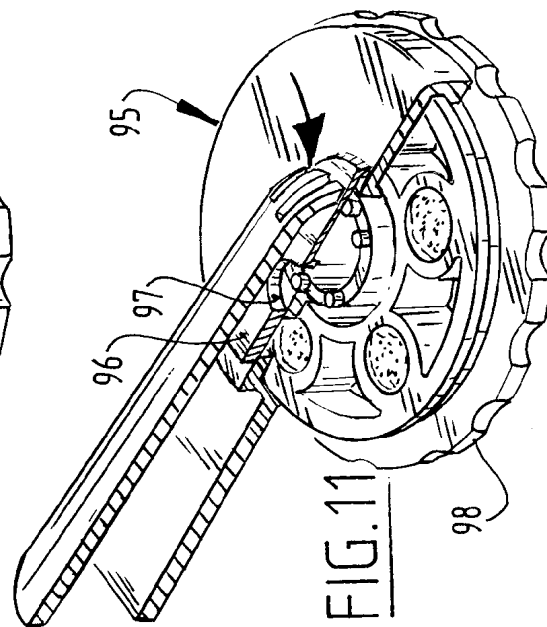
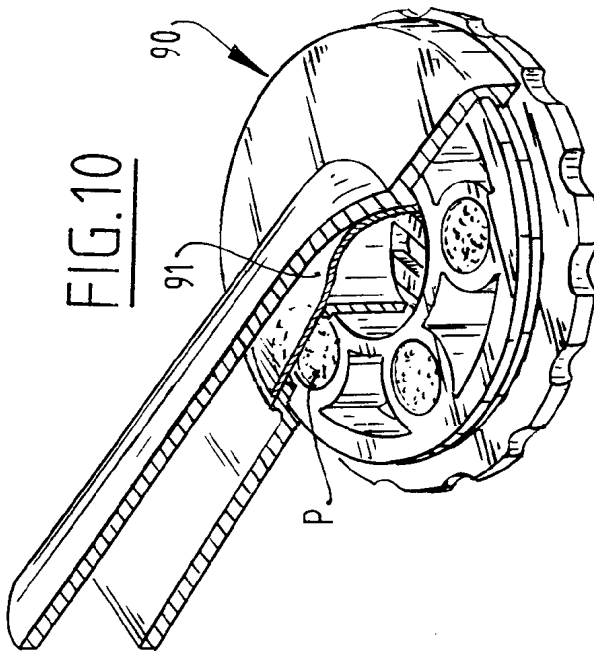
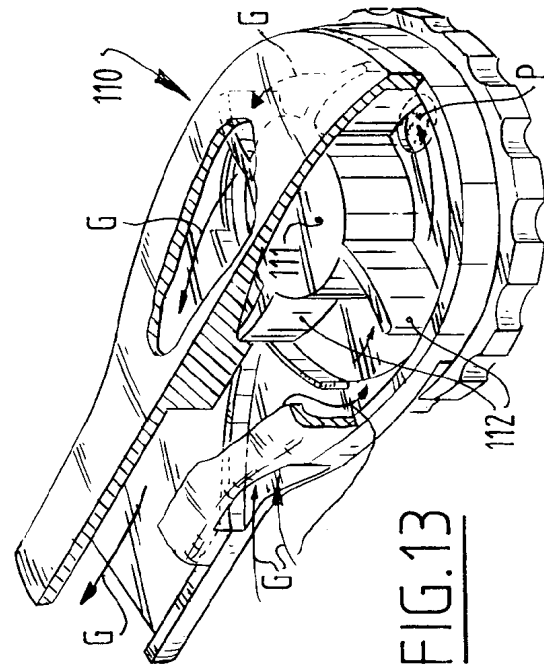
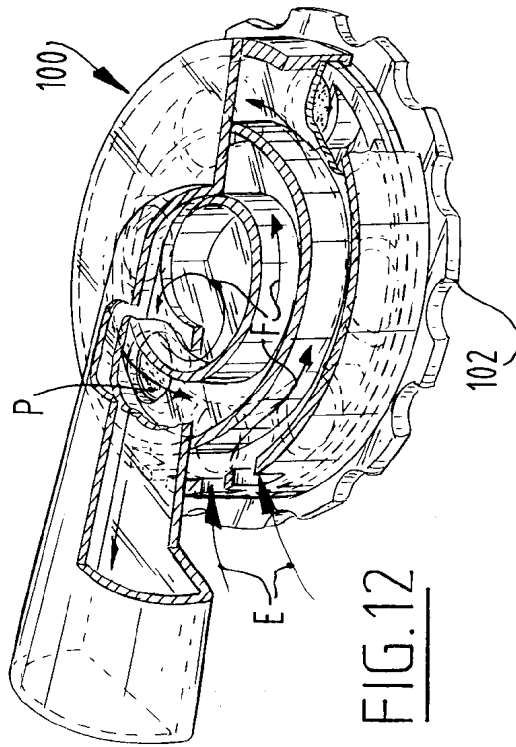


FIG. 5







# INTERNATIONAL SEARCH REPORT

International Application No

PCT/NL 99/00028

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A61M15/00

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 860 740 A (KIRK WILLIAM F ET AL) 29 August 1989	1-3, 9, 12, 13
Y	see column 11, line 45 - column 12, line 19; figures 7, 8	4, 6, 8, 11, 19, 21-24
Y	WO 97 25086 A (GLAXO GROUP LTD ; ANDERSON GREGOR JOHN MCLENNAN (GB); WALKER RICHAR) 17 July 1997	4, 6, 24
A	see page 12, paragraph 2; figures	8
Y	DE 38 23 535 A (REENTS HEINRICH PROF DR ING) 18 January 1990 see column 3, line 42 - line 47	8
Y	US 5 301 666 A (LERK COENRAAD ET AL) 12 April 1994 see column 5, line 51 - line 61	11
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☒ Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search

29 April 1999

Date of mailing of the international search report

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